

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**  
**CONSERVATION CROP ROTATION**

(Ac.)

**CODE 328**

**DEFINITION**

Growing crops in a planned sequence on the same field.

**PURPOSE**

This practice may be applied to support one or more of the following:

1. To reduce sheet-and-rill or wind erosion;
2. To improve soil quality;
3. To manage the balance of plant nutrients;
4. To supply nitrogen through biological nitrogen fixation to reduce energy use;
5. To conserve water;
6. To manage plant pests (weeds, insects, and diseases);
7. To provide feed for domestic livestock;
8. To provide annual crops for bioenergy feedstocks;
9. To provide food and cover for wildlife, including pollinator forage, cover, and nesting.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to all cropland land where annually-planted crops make up at least one-third of the crop sequence.

For the purposes of this practice, a cover crop is considered a crop in the rotation.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Crops shall be grown in a planned sequence as specified in the conservation plan or job sheet.

Crops shall be adapted to the climatic region, soils, and goals of the producer. Select adapted crops and varieties, listed in appropriate university publications or other approved sources.

The selected crops and the cropping sequence shall produce sufficient and timely quantities of biomass or crop residue, in conjunction with other practices in the management system, to reduce sheet and rill and/or wind erosion to the planned soil loss objective.

**Additional Criteria to Improve Soil Quality**

The crops grown shall produce a positive OM (Organic Matter) subfactor value over the life of the rotation, as determined by the Soil Conditioning Index.

**Additional Criteria to Manage the Balance of Plant Nutrients**

Determine crop selection and sequence according to an approved nutrient balance procedure.

To reduce excess nutrients in the soil profile, use crops with:

1. Quick germination and root system formation;
2. A rooting depth sufficient to reach the nutrients not removed by the previous crop; and,
3. Nutrient requirements that readily utilize the excess nutrients.

**Additional Criteria to Supply Nitrogen Through Biological Nitrogen Fixation to Reduce Energy Use**

When crop rotations are designed to add nitrogen to the system, nitrogen-fixing crops shall be grown immediately prior to or interplanted with nitrogen-requiring crops.

**Additional Criteria to Conserve Water**

Select crops and varieties and the sequence of crops based on local climate potential and/or irrigation water availability and an approved water balance procedure.

**Additional Criteria to Manage Plant Pests (Weeds, Insects, Diseases)**

Design the crop sequence to break pest lifecycles and/or to allow the use of a variety of control methods.

Remove susceptible crops and alternate host crops from the rotation for the period of time needed to break the life cycle of the targeted pest.

Resistant varieties, listed in appropriate university publications or other approved sources, shall be selected where there is a history of pest problems.

Control noxious weeds as required by Delaware State Law.

**Additional Criteria to Provide Feed for Domestic Livestock**

Select crops that balance the feed supply with livestock numbers. Determine the required amount of selected crops using an approved forage-livestock balance procedure.

**Additional Criteria to Provide Annual Crops for Biofuel Feedstock.**

Select crops suitable for the site conditions and the biofuel feedstock objectives.

**Additional Criteria to Provide Food and Cover for Wildlife**

Select the crops and crop management activities that provide either food or cover for the targeted wildlife species using an approved habitat evaluation procedure.

*Note: Specific cost-sharing programs or other funding sources may dictate criteria in addition to, or more restrictive than, those specified in this standard.*

**CONSIDERATIONS**

**Additional Considerations to Increase Cropping System Diversity**

For crop diversity, the planned crop sequence should contain different crop types such as: warm season grass (WSG); warm season broadleaf (WSB); cool season grass (CSG); cool season broadleaf (CSB):

1. A two-crop sequence that contains a warm season and a cool season crop (for example, vegetable-cover crop);
2. A three-crop sequence that contains warm and cool season crops, neither should be grown in consecutive years (for example, corn-small grain-soybeans);
3. A four-crop sequence that contains two different crop types, neither should occupy more than half of the sequence (for example, corn-small grain-soybeans-cover crop);
4. Longer crop sequences may have more than two consecutive years of the same crop type, as long as that crop type does not occupy more than  $\frac{2}{3}$  of the crop rotation (for example, corn-corn-corn-small grain-soybeans).

### **Additional Considerations to Reduce Sheet and Rill or Wind Erosion.**

Selection of high-residue producing crops and varieties, use of cover crops, and adjustment of plant density and row spacing can enhance production of the kind, amount, and distribution of residue needed to reduce erosion.

Crop damage by wind erosion can be reduced by selecting crops that are tolerant to abrasion from wind blown soil or tolerant to high wind velocity.

If crops sensitive to wind erosion damage are grown, the potential for plant damage can be reduced by crop residue management, field windbreaks, herbaceous wind barriers, intercropping, or other methods of wind erosion control.

### **Additional Considerations to Improve Soil Quality**

Maintaining or improving soil organic matter content can be enhanced by increasing or retaining crop residues and reducing tillage. In addition, animal wastes, green manure crops (cover crops), or mulch may be applied to supplement the biomass produced by crops in the rotation.

Soil compaction can be reduced by adjusting crop rotations to include crops with deep roots that extend to and penetrate compacted soil layers. Avoid field operations when the soils are wet.

### **Additional Considerations to Supply Plant Produced Nitrogen to Conserve Energy**

Select crops that have the potential to provide larger amounts of biologically fixed nitrogen.

Select crop and management strategy to match nitrogen release from residues of nitrogen fixing crop with nitrogen uptake by subsequent crop, taking into account climate, soil physical and chemical properties, C:N ratio of residues of the nitrogen fixing crop, and the timing of nitrogen demand by the subsequent crop.

### **Additional Considerations to Conserve Water**

Where precipitation is limited, seasonal, or erratic, moisture can be conserved for crop use by maintaining crop residues on the soil surface to increase infiltration and to reduce runoff and evaporation. Where winter precipitation occurs as snow, additional moisture can be obtained for crop uses by trapping snow with standing residue.

### **Additional Considerations to Manage Plant Pests**

Where pesticides are used, use a combination of pesticide application methods and crop rotation to reduce the potential for pesticide carryover or adverse affects on aquatic wildlife or habitat through runoff.

Biological control of various crop pests can be provided by:

1. Crop rotations that include plant species such as clover or buckwheat that provide habitat for beneficial insects;
2. The use of plant species that produce chemical substances that control nematodes or other disease causing organisms (allelopathy);
3. The use of beneficial insectary field borders; and,
4. Intercropping of species that provide pollinator forage and reproductive habitat for beneficial insects.

### **Additional Considerations for Wildlife, Beneficial Insects, and Pollinators**

Crop residues may be a valuable food source for wintering wildlife. Leaving several rows unharvested around the edges of the field or planting borders of various forbs will provide protection and/or food for overwintering wildlife and for beneficial insects and pollinators.

Retaining bolting or flowering crops after harvest may provide beneficial insects with an important food source when and where pests are active.

Careful consideration should be given to pesticides applied to crops raised for wildlife, particularly if nesting habitat or pollinator forage species are present.

When insect-pollinated crops are part of the rotation, planting them no more than 800 feet from their previous location may help maintain local populations of native bees that have become established because of the presence of that crop.

To maintain stable pollinator and beneficial insect populations, ensure that the same overall density of floral resources is maintained from year-to-year. For example, two years of flower-rich plantings, followed by a year of only grasses, will cause a rapid decline in pollinator populations.

## **PLANS AND SPECIFICATIONS**

Plans and specifications for this practice shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail to ensure successful implementation of this practice, and may be recorded in narrative form, on job sheets, or other approved forms.

The following components shall be included:

1. Field number and acres;
2. Purpose(s) of the crop rotation;
3. The sequence of crops to be grown;
4. The crop types to be grown;
5. Length of time each crop/crop type will be grown in the rotation; and,
6. Total length of rotation.

## **OPERATION AND MAINTENANCE**

Rotations shall provide for acceptable substitute crops in case of crop failure or shift in planting intentions for weather related or economic reasons. Acceptable substitutes are crops having similar properties that will accomplish the purpose of the original crop.

Evaluate the rotation and the crop sequence to determine if the planned system is meeting the planned purposes.

## **Record Keeping**

It is the responsibility of the landowner/client to main records as needed to document plan implementation. Records will include actual implementation details of all applicable components under Plans and Specifications.

## **SUPPORTING DATA AND DOCUMENTATION**

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Extent of practice in acres and field number(s) where the practice is located;
2. Assistance notes. The notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom;
3. Completed copy of the appropriate job sheet(s) or other approved form.

## **REFERENCES**

1. Green, B., D. Kaminski, B. Rapp, M. Celetti, D. Derksen, L. Juras, and D. Kelner. 2005. Principles and practices of crop rotation. Saskatchewan Agriculture and Food.
2. Karlen, D.L., E.G. Hurley, S.S. Andrews, C.A. Cambardella, D.W. Meek, M.D. Duffy, and A.P. Mallorino. 2006. Crop rotation effects on soil quality at three northern corn/soybean belt locations. *Agron. J.* 98:484-495.
3. Liebig, M.A., D.L. Tanaka, J.M. Krupinsky, S.D. Merrill, and J.D. Hanson. 2007. Dynamic cropping systems: Contributions to improve agroecosystem sustainability. *Agron. J.* 99:899-903.